Astronomy from an armchair

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Abstract. *In this paper, we will give a short overview of the project "Astronomy from an armchair" currently under construction at the Faculty of Sciences and Mathematics, University of Niš. Also, the theoretical basis of a new concept of amateur astronomy called "Astronomy from an armchair" will be displayed.*

INTRODUCTION

"Astronomy from an armchair" is a term for a new concept for amateur astronomers to be able to observe from their homes using the Internet. They are able to learn particular astronomical topics accessing large databases available on the Internet, to involve in space explorations, to send their observational data and photographs, analyze available data in virtual observatories, to perform observations using distant robotized telescopes, to write and publish papers, discuss on Internet forums, attend on-line seminars (webinars) and all this only by using their own computers from their own homes. This concept is a practical example of contribution of the Internet in appearance of new products and services, evolving the existing and promoting new forms of organization. It means that the problems of spatial distances which made international cooperation difficult vanished, as well as the equipment problem (equipment being inaccessible for many individual astronomers due to high prices).

This concept also solves the problem of time. Specifically, users can access the equipment at a great distance. In this way, some users may do their own observations during the daylight on their location, because the used telescope is in the location where, at that moment, is night. This ensures that in schools, practical parts of lessons, can be done during the day. This concept includes: robotic observatories, virtual observatories and astronomy online broadcasting.

Robotic Observatory (telescope) is defined as an astronomical instrument and detection system which allows the observation without the need for physical intervention of an operator. In astronomy, a telescope is considered robotic when observations can be performed without operator intervention on the equipment (even if one has to start and complete a monitoring session on it).

Robotic telescopes are complex systems consisting of several subsystems. These subsystems include devices that allow: 1) control of the telescope, 2) control of the detector (CCD camera usually), 3) control of the dome (roof) of observatory, 4) control of the telescope's focuser, 5) tracking of celestial objects within a few arc seconds to a few arc minutes, 6) avoidance of wrapping the cord around the mount, 7) successful navigation of the difficult points in the sky (the meridian, zenith, the celestial pole), 8) knowledge of the horizontal border movement of the telescope limits, 9) initial "parking" position of telescope, 10) exposure control and camera temperature, 11) filter control, 12) storing images and their subsequent processing using the dark frame and flat field, 13) synchronizing movement of the telescope with the sky, 14) synchronizing movement of the dome with the movement of the telescope and so on. Most robotic telescopes are small telescopes. While large observatory instruments may be highly automated, few are operated without attendants. Each observatory should also have its own weather station.

The emergence of the Internet has enabled robotic telescopes to become accessible to a large number of users worldwide. In the past, robotic telescopes have used their own graphical interface that is limited to only one type of computer platform or simple communication via e-mail [1]. The production of its own graphical user interface was a complicated task that consumed a lot of resources and was not accessible to a wide range of users [1].

Using the Internet in addition to reducing costs in communicating with customers provides an opportunity to a wider range of potential users with the ability to get to know the telescope control, and development of e-commerce and virtual money made payment for services far easier.
With the Internet robotic telescopes can become a significant element in teaching of astronomy and to provide the opportunity for simultaneous communication, data exchange and validation of data obtained by observation. The same goes for other elements within the concept of astronomy from an armchair where the Internet is one of the main instruments in the practice of astronomy. Figure 1. shows an example of a scheme of a robotic observatory. The robotic observatory whose scheme is presented is the one of the University of Bradford.

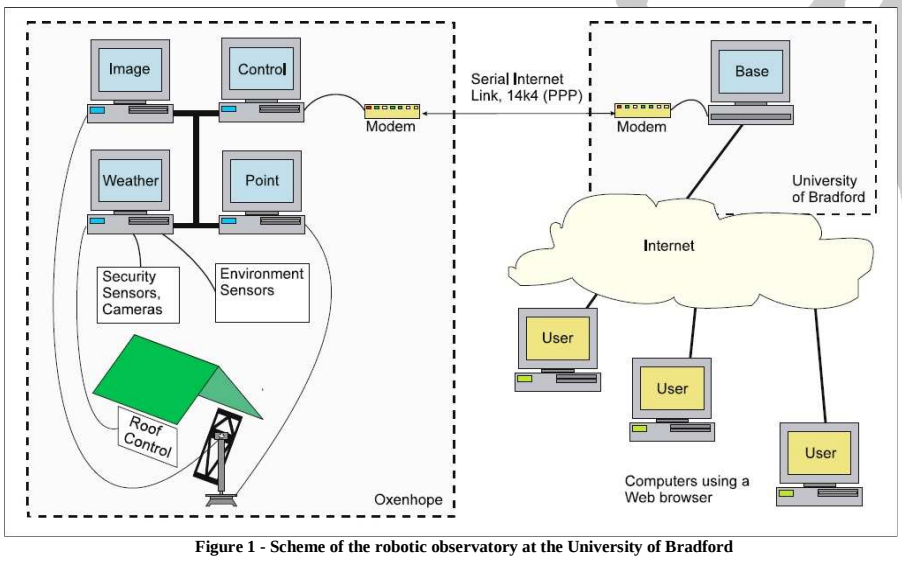


Figure 1 - Scheme of the robotic observatory at the University of Bradford

STUDENTS' PROJECT "ASTRONOMY FROM AN ARMCHAIR"

"Astronomy from an armchair" is a project realized by a five-member team of students form the Faculty of Science and Mathematics, Niš, in cooperation with members of the "Alfa" astronomical society from Niš [2]. The team of students is consisted of: Zoran Tomić, the coordinator of the project, Milan Milošević, Marko Rančić, Saša Rančev and Nenad Živić [3]. The mentor of the project is prof. Dr. Dragan Gajić. The aim of the project is the creation of the first astronomical observatory in Niš, which will be stationed on the roof of building of the Faculty, and its setting in operation. This obseratory will enable, apart from the possibilities of quality astronomical observations and astrophotography, the observations to be made over the Internet utilizing the concept of "Astronomy from an armchair". Its services will be available to highschool students, faculty students, and also to all others interested.

The observatory will be equipped for night-sky and Solar observations. Complete equipment will be controlled over a computer and observations will be possible over the Internet. Handling the equipment will be simple and will not require significant prior observational experience. In the following period, video instructions for the usage of equipment will be made for future users. These intructions will be object-type specific, as different objects require different methods of observation and photographing. The team members will be available for users in need of help and instructions.

Preparation of the observatory is currently in progress at the Faculty and during this time, the Project team is organizing numerous public observations and popular lectures for people of all academic backgrounds.

The progress of activities in connection with the project can be followed at the project website www.teleskoponline.info and on the project Facebook page www.facebook.com/teleskoponline.

A. Ecquipment

In the spherical-shaped observatory, 2,5 meters in diameter, a Meade LX200 GPS telescope will be installed. This telescope posesses a GPS device which enables precise evaluation of the geographical coordinates, time and time zone at the position of the telescope. For the telescopes with Alt/Azm mount, as the one used in this procect is, polar alignment and levelization is needed to minimalize the pressure exerted upon the motors that enable tracking of astronomical objects. The telescope itsefl posesses a compass and levels according to which it automatically locates North and levelizes itself, so presence of an operator who would manualy do this is not needed. The telescope also performs calculations of the ephemeris based on its current location, thereby enabling precise location and tracking of astronomical objects. The objective radius is 203mm, the focal distance is 2000mm, f/10 with Ritchery-Cretien optics [3], which is excellent for astrophotography. The telescope is fully computer-controled, by its own computer, meaning that an external computer is not required for the operator to manipulate the telescope. The telescope's database contains roughly 145000 entries of diferent astronomical objects. The database is regularly updated with information of newly found objects. The operator is also given the possibility of making manual updates himself.

Figure 2 - Meade LX 200R 8" Telescope, Meade DSI III CCD camera and Lunt Solar Telescope

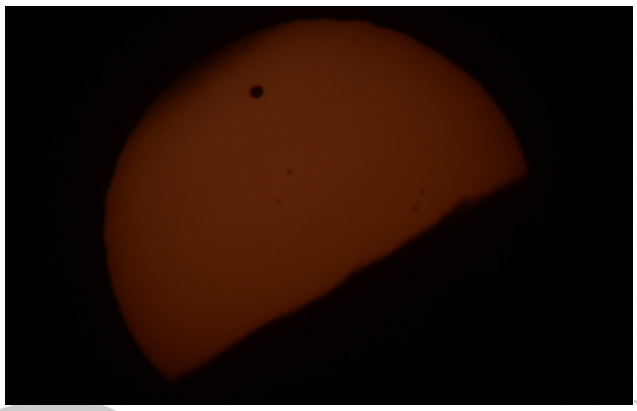
For astrophotography a Meade DSI III Color CCD 1,4 megapixel resolution camera was acquired. This camera allows a high quality, almost no noise photograph to be taken, and it also allows the photographs to be used in photometric research of the observed objects, by converting them to FITS format. Auto Star Suite software which goes along with the camera is used for controlling the telescope and the CCD camera. The software automatically removes the noise from photographs during the exposition. Expositions can last from 1/10000 s up to 1 h. High Sensitivity Color Sony EXview HAD™ CCD Sensor is built into the camera [4]. The selected camera instantly outputs high-quality color photographs, so that it would be easily used with a minimal amount of prior experience. This CCD camera can be used for photographing deep space objects like galaxies, stellar clusters, planetary nebulae, but objects like the Solar system planets and the Moon also. There is a very interesting possibility of taking a series of Jupiter photographs which after an Auto Star Suite processing can result in an animation of Jupiter's rotation.

Lunt solar telescope with a 60mm objective diameter and a focal distance of 500mm was obtained so that the Sun can also be observed and photographed. This telescope is made specifically for this purpose. It contains an H alfa filter, which reduces the intesity of Solar radiation and allows observation of the Sun [5]. Aside from sunspots, Solar prominences, Solar flares, facula, etc. can also be seen on the surface of the Sun.

B. Project activities and results

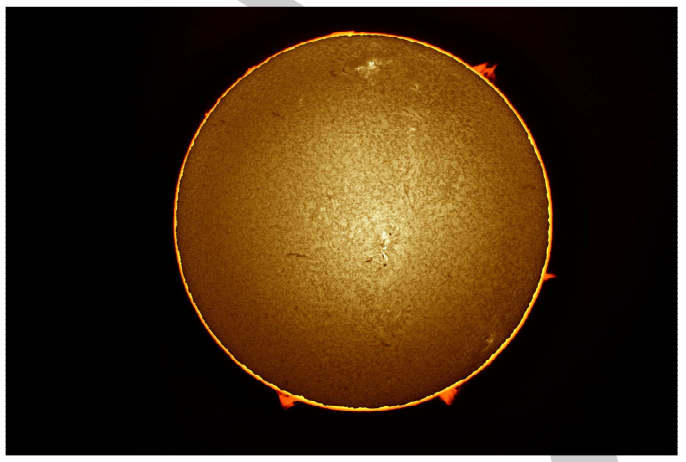
Apart from the construction of the astronomical observatory, popularization of astronomy is also a vital part of the project. Public observations of astronomical objects (from the local fortress) will be organized on a regular basis, where people interested in astronomy will have an opportunity to see for themselves how the telescope is used and how the objects are seen through it. Aside from night-time observations, Sun observations will also be organized. During this period many activities have already been succesfully organized. Photographs from some of them are presented.

Transit of Venus


Days of the Sun and Moon





"A look to the Universe neighbourghood" during the international "Explorers' Night" manifestation



CONCLUSION

„Astronomy from an armchair" is a project currently being realized at the Faculty of Science and Mathematics in Niš. The aim of the project is to elevate the possibility of amateur practice of astronomy to a much higher level than it was on before. The same, of course, goes for professional astronomy also. Thea equipment acquired allows quality observations of astronomical objects via the Internet even from one's home computer. Public observations which will also be organized over the Internet will give the opportunity to see objects in much higher detail than in standard telescope observations. The project also includes an astronomy and astrophotography course realization, during which the first group of people which will use this equipment will be taught on how to use it. The construction of the observatory is curently being finished.

ACKNOWLEDGEMENTS

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